TOF Status and Improvement

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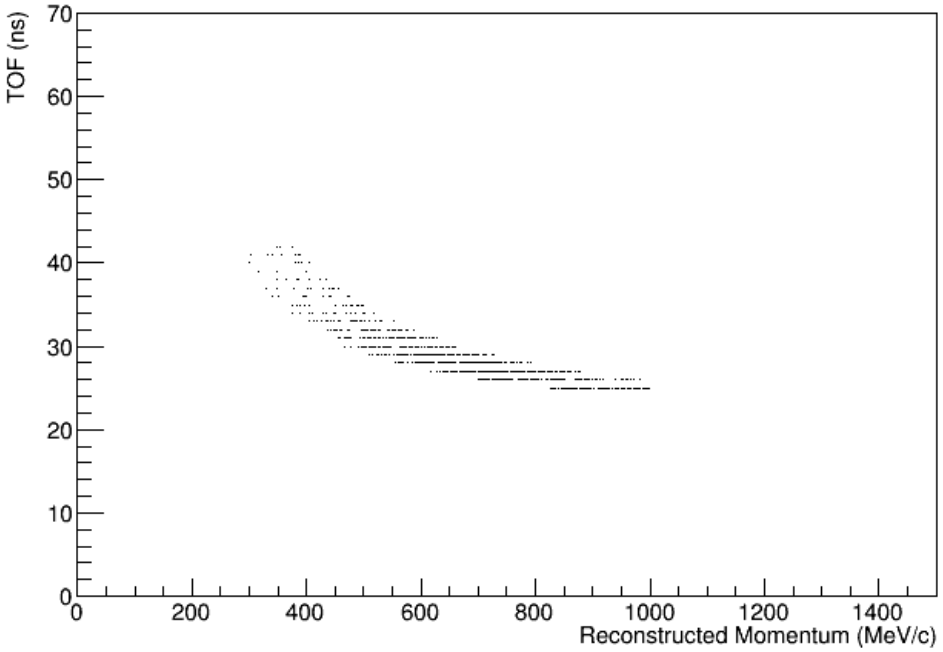
TOF waveform is sampled at 1 ns in the DAQ.

Current TOF hit finding algorithm records a hit after the sampled waveform passes a threshold value, causing TOF also to have a resolution of 1 ns.

In a scatter plot of TOF vs. WCTrack:



Plot of 1300 K+ Candidate events from Run II

P reconstruction is not discretized, causing the nice continuous appearance.

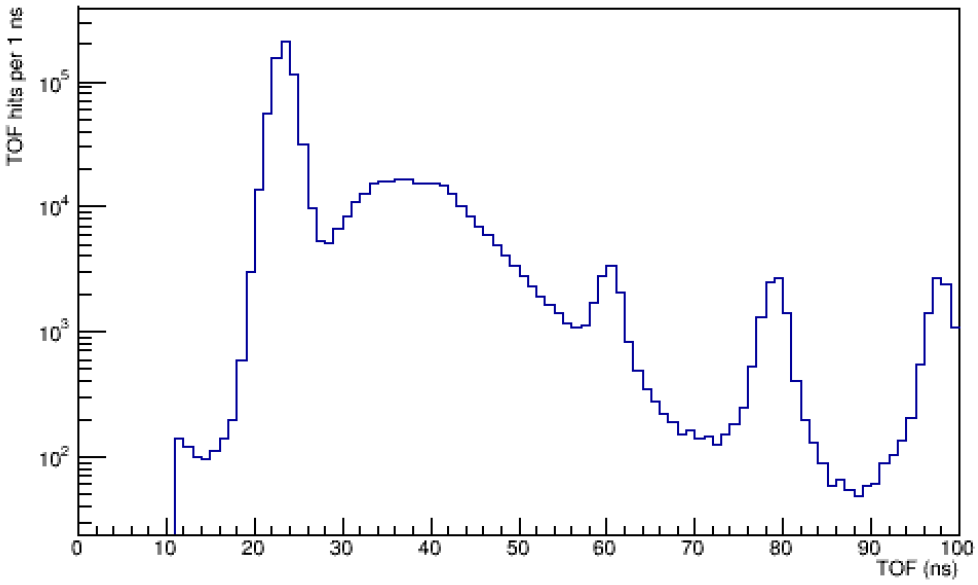
Issue has been unintentionally 'covered up' by using histograms with bins of 1 ns to construct this plot

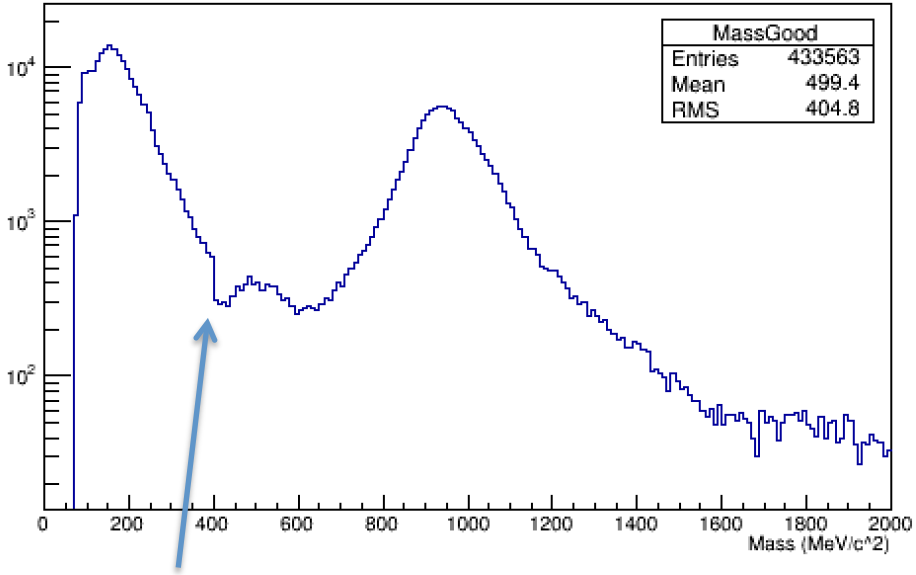
Further issue In Mass Reco.

Mass reconstruction relies upon TOF:

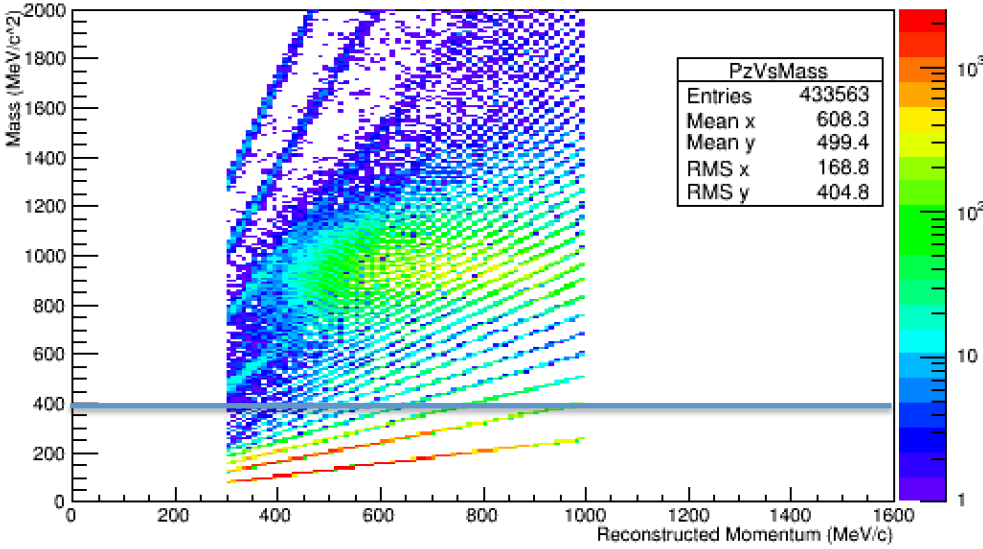
$$m = \frac{p}{c}\sqrt{(\frac{c * TOF}{\ell})^2 - 1}$$

Mass reconstruction plots develop a shelf at the upper end of the Pi/Mu spectrum because such species only arrive into ~5 bins in the TOF reconstruction





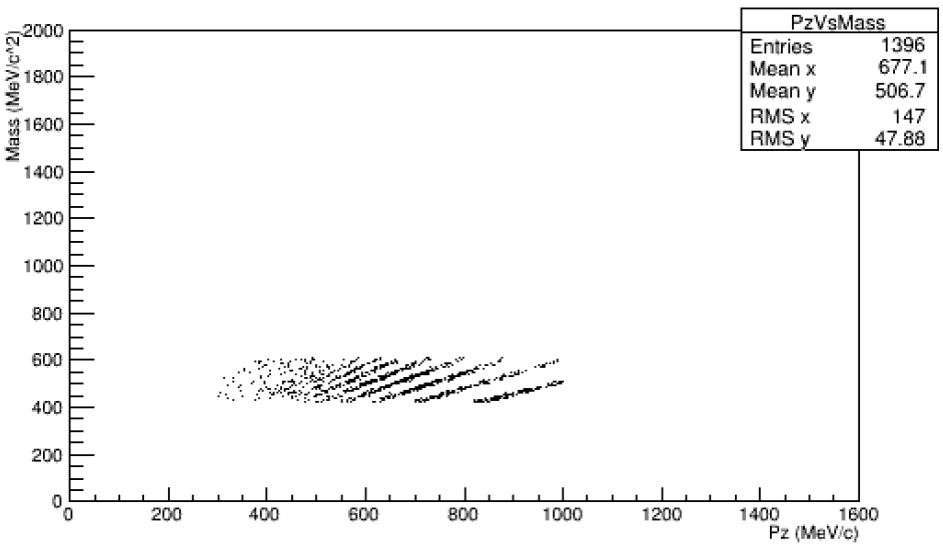
Fast moving Pi/Mu low mass resolution

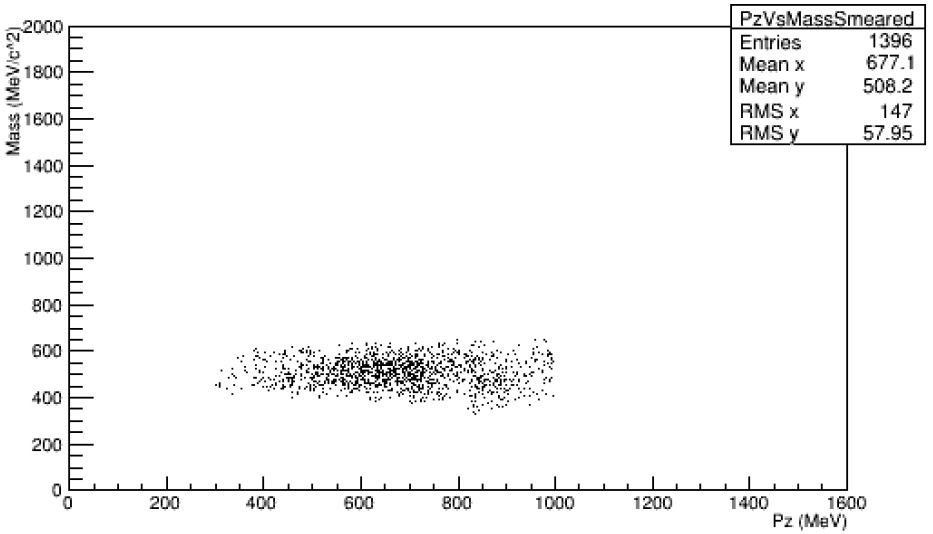


Mass vs. P graph (for beam composition study) becomes stripy.

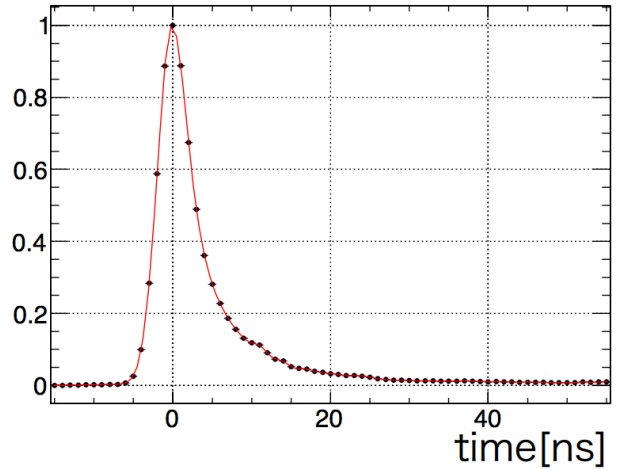
Proof of TOF discretization problem

To prove that TOF was the problem in the Mass vs. P plot, applied a uniform smear of +/- 1 ns on the TOF.





Typical waveform (template) for AG DS E



Better hit find can be achieved by fitting the TOF waveform with the expected waveform, a method used in the aerogel analysis.

LArIAT needs someone to step up to do this fix.